

IMPROVED LAYERS OF GROUP III - NITRIDE SEMICONDUCTOR

BACKGROUND

Field of the Invention

This application is a Continuation of 10/179,806, now U.S Patent No 6,699,760.

The invention relates generally to group III-nitride semiconductors and to methods for fabricating layers of such semiconductors.

Discussion of the Related Art

A variety of electronic devices use layers of group III-nitride semiconductors.

5 Herein, group III-nitride semiconductors refer to semiconductors having lattices with primitive cells that include nitrogen and one or more group III metals. Exemplary of such semiconductors are gallium-nitride (GaN) or aluminum-gallium-nitride (AlGaN).

10 The manufacture of a layer of group III-nitride semiconductor involves epitaxial growth on a crystalline substrate. In epitaxial growth, the crystalline substrate's lattice controls the initial placement of atoms in the growing layer. Since available crystalline substrates do not have lattices that closely match the lattice of either GaN or AlGaN, epitaxial growth of layers of these group III-semiconductors is presently performed on crystalline substrates with non-matching lattice constants.

15 Figure 1 shows a GaN layer 10 that was epitaxially grown on a crystalline substrate 12 with non-matching lattice constants. The mismatch between the lattice constants of the substrate 12 and GaN caused production of lattice defects 14, 15 in the portion 13 of the GaN layer 10 that initially grew on the substrate 12. Some of these initial lattice defects 14 subsequently grew through the entire GaN layer 10.

20 Herein, lattice defects 14 that grow through an entire layer of sequence of layers are known as threading defects.

25 Threading defects are undesirable in electronic devices, because such defects interfere with carrier transport vertically through and laterally across a layer. In particular, a threading defect often has a higher conductivity than bulk semiconductor and thus, carries more current through a layer than defect-free semiconductor surrounding such a defect. For this reason, a high density of threading defects will partially short out a semiconductor layer so that the conductivity across the layer differs significantly from the conductivity of a bulk semiconductor.